We Claim:

1. A method for the production of a nanoscale particle array, comprising: growing one or more metals or non-metals in a plurality of nanopores located in a surface of a substrate, wherein said growing is performed by reverse-pulse electrodeposition using a rectangular waveform pulse.

2. The method of claim 1, wherein said rectangular waveform pulse has a peak-to-peak amplitude of 20 to 100 V for a cathodic portion of the pulse and a peak-to-peak amplitude of 20 to 100 V for an anodic portion of the pulse.

3. The method of claim 2, wherein said rectangular waveform pulse has an overall duration of 10^{-4} to 10^{-2} s.

4. The method of claim 3, wherein said rectangular waveform pulse has a frequency of 1 to 10^4 Hz.

5. The method of claim 1, wherein said rectangular waveform pulse is a symmetrical pulse.

6. The method of claim 1, wherein said rectangular waveform pulse is an asymmetrical pulse.

7. The method of claim 1, wherein said one or more metals are selected from the group consisting of magnetic metals, non-magnetic metals, semiconductors and metal oxides.

8. The method of claim 7, wherein said one or more metals are selected from the group consisting of magnetic metals and alloys thereof.

9. The method of claim 8, wherein said magnetic metals are selected from the group consisting of Fe, Co, Ni and alloys thereof.

10. The method of claim 1, wherein said substrate is aluminum.

11. The method of claim 1, wherein said plurality of nanopores are present in said substrate at a density of from 10^6 to 10^{12} cm^{-2}.

12. A method for producing nanoscale particle arrays, comprising:

forming a plurality of nanopores in a surface of a substrate; and

growing one or more metals or non-metals in said plurality of nanopores, wherein said growing is performed by reverse-pulse electrodeposition using a rectangular waveform pulse.

13. The method of claim 12, wherein said rectangular waveform pulse has a peak-to-peak amplitude of 20 to 100 V for a cathodic portion of the pulse and a peak-to-peak amplitude of 20 to 100 V for an anodic portion of the pulse.

14. The method of claim 13, wherein said rectangular waveform pulse has an overall duration of 10^{-4} to 10^{-2} s.

15. The method of claim 14, wherein said rectangular waveform pulse has a frequency of 1 to 10^4 Hz.

16. The method of claim 12, wherein said rectangular waveform pulse is a symmetrical pulse.

17. The method of claim 12, wherein said rectangular waveform pulse is an asymmetrical pulse.

18. The method of claim 12, wherein said one or more metals are selected from the group consisting of magnetic metals, non-magnetic metals, semiconductors and metal oxides.

19. The method of claim 18, wherein said one or more metals are selected from the group consisting of magnetic metals and alloys thereof.

20. The method of claim 19, wherein said magnetic metals are selected from the group consisting of Fe, Co, Ni and alloys thereof.

21. The method of claim 12, wherein said substrate is aluminum.

22. The method of claim 12, wherein said plurality of nanopores are present in said substrate at a density of from 10^6 to 10^{12} cm^{-2}.

23. The method of claim 12, wherein said forming step is performed by anodization of the surface of the substrate.

24. The method of claim 23, wherein said anodization is performed in a solution comprising oxalic acid, and said substrate is aluminum.

25. A method for production of a nanoscale particle array, comprising:

a step of growing one or more metals or non-metals in a plurality of nanopores formed in a surface of a substrate.

26. The method of claim 25, wherein said step of growing is preceded by a step of forming said plurality of nanopores in the surface of the substrate.

27. A nanoscale particle array, comprising:

a substrate having a plurality of nanopores in a surface thereof; and

one or more metals or non-metals deposited in said plurality of nanopores to a depth of at least 5 nm and with coercivity of at least 500 Oe.

28. The nanoscale particle array of claim 27, wherein said one or more metals are selected from the group consisting of magnetic metals, non-magnetic metals, semiconductors and metal oxides.

29. The nanoscale particle array of claim 28, wherein said one or more metals are selected from the group consisting of magnetic metals and alloys thereof.

30. The nanoscale particle array of claim 29, wherein said magnetic metals are selected from the group consisting of Fe, Co, Ni and alloys thereof.

31. The nanoscale particle array of claim 27, wherein said substrate is aluminum.

32. The nanoscale particle array of claim 27, wherein said plurality of nanopores are present in said substrate at a density of from 10^6 to 10^{12} cm^{-2}.

33. A magnetic information storage medium, comprising:

a substrate having a plurality of nanopores in a surface thereof; and

one or more metals deposited in said plurality of nanopores to a depth of at least 5 nm and with coercivity of at least 500 Oe, wherein the magnetic information storage medium has a recording density of at least 40 Gb/in^2.

34. The magnetic information storage medium of claim 33, wherein said one or more metals are selected from the group consisting of magnetic metals, metal oxides and magnetic metal alloys.

35. The magnetic information storage medium of claim 34, wherein said one or more metals are selected from the group consisting of magnetic metals and alloys thereof.

36. The magnetic information storage medium of claim 35, wherein said magnetic metals are selected from the group consisting of Fe, Co, Ni and alloys thereof.

37. The magnetic information storage medium of claim 33, wherein said substrate is aluminum.

38. The magnetic information storage medium of claim 33, wherein said plurality of nanopores are present in said substrate at a density of from 10^6 to 10^{12} cm^{-2}.

39. A magnetic information storage medium, comprising:

a substrate; and

means for providing a recording density of at least 40 Gb/in^2 on a surface of said substrate.